

# Hearing Protection Devices (HPD's)

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Mining Hearing Loss Prevention  
Workshop  
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Pittsburgh Research Laboratory



# Outline

- ❖ Overview of Hearing Protectors (HPD's)
- ❖ Advantages/Disadvantages of HPD types
- ❖ Insertion method
- ❖ Noise reduction ratings
- ❖ Derating HPD's
- ❖ Dual Protection

# Have you heard?



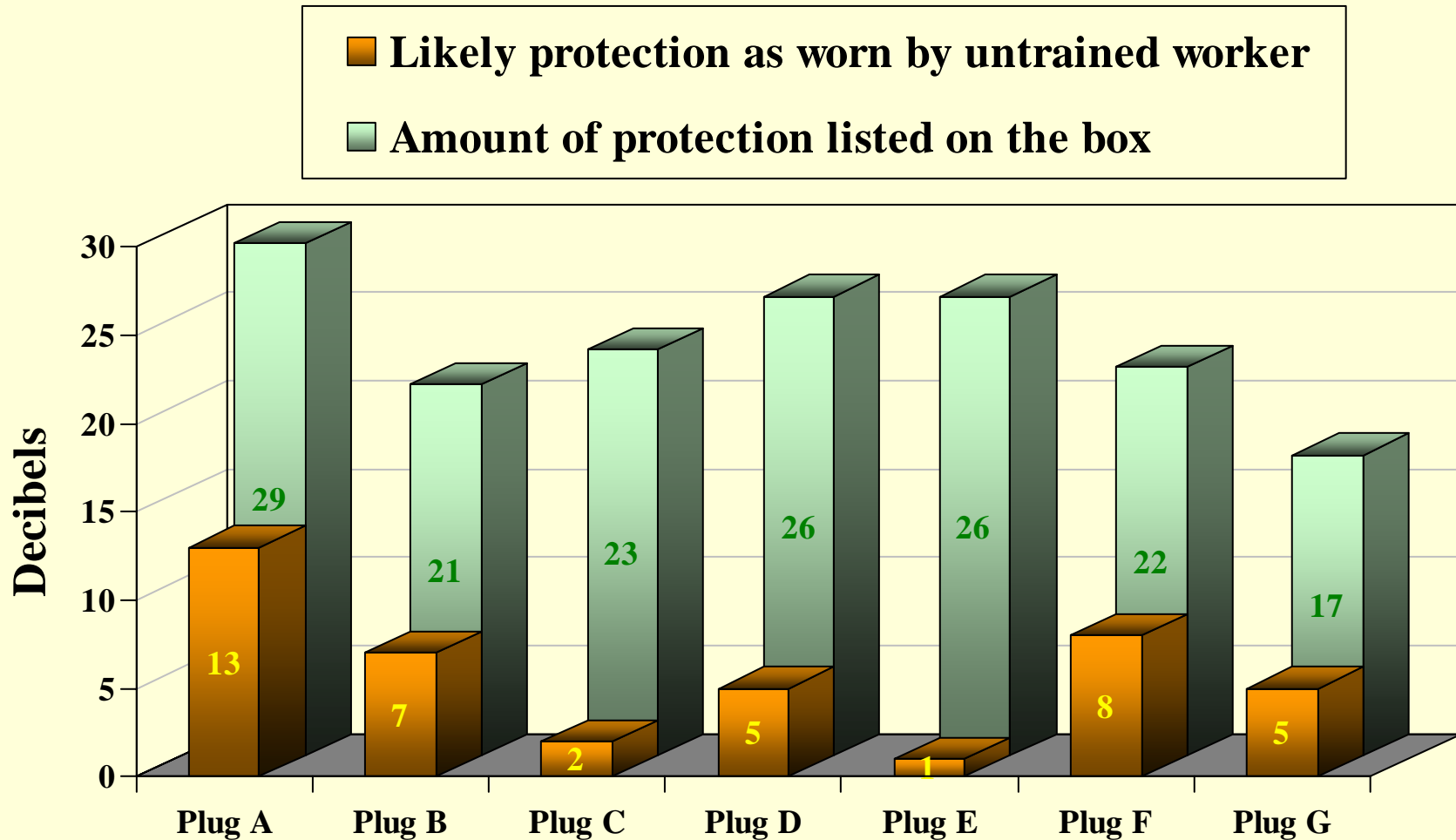
□ To reduce noise exposure, remember 3 key points:

- Less **Time**
- Further **Distance**
- Use **Shielding**--Equipment (barrier)  
Ear (HPD)

# Hearing Loss Prevention Approaches

- Remove noise
- Remove worker  
then
- Protect the worker...use HPD's

# ***Problem: Earplugs are rarely worn effectively***



# When to wear hearing protection

- If have to raise voice to speak to a person 2-3 feet away
- If your ears “ring” after noise exposure
- If after leaving the noise area, and sounds are “dull, flat or muffled”
- If noise is measured at 85dB(A) and above

# Hearing protection-how does it work?

- A device worn to reduce (not eliminate) the level of sound entering the ear
- Considered last choice against hazardous noise
- Generally provide greatest protection from high frequency noise and less in low frequency noise
- To be **effective**, must fit properly

# Hearing Protection Devices

Best protector-**REMOVE** noise

There is NO single “best” type for all individuals or situations.

- Varies with:
  - Individual comfort
  - Size of ear canals
  - Noise environments
  - Work activities
  - Environmental conditions



# 4 C 's for Wearing HPD's

- The “ **Best**” HPD is one that a worker will wear:
  - ***Clean*** - plugs & hands for insertion
  - ***Consistent*** - for levels 85 dB(A) and above
  - ***Correct*** - insertion method
  - ***Comfortable*** – for user, offer choices

**\*\* Wear HPD's “ *every time and all the time*” in hazardous noise**

# How to make HPD's more effective

Even if a worker wears HPD's, they often do not wear it correctly

- Simplify insertion instructions
- Practice correct insertion method
- Train employee-care & use

# Hearing Protection Devices

## Factors determining worker acceptance of HPD's:

- Convenience, availability and choices
- Beliefs that the protector
  - Can be worn correctly
  - Will prevent hearing loss
  - Will *not* impair important sounds
- Comfort
- Adequate noise reduction
- Ease of fit
- Compatible with other personal protective equipment

# Hearing Protection Devices

## Foam Plugs



- ¼-½ inch foam/fiber- rolled, inserted and held (30–40 sec.) to expand, to fill ear canal
- Available in standard sizes
- Generally comfortable to wear
- Reusable on a limited basis
  - Not washable
  - Discard if wet, dirt or wax present

# Hearing Protection Devices

## *Advantages & Disadvantages*

### Foam Plugs

#### Advantages:

- Small
- Inexpensive  
(10-20 cents/pkg),  
depending on type
- Portable
- Generally more  
comfortable than others
- Worn effectively  
without interference  
from hair or glasses

#### Disadvantages:

- Can be hard to fit,  
esp. small canals
- Can introduce dirt into  
canal
- Protection level can  
vary with:
  - canal anatomy
  - insertion method
  - wax/hair in canals

# Hearing Protection Devices

## *Proper Fit*

- After the plug is inserted, check the fit. The body of the ear plug should be within the canal, and not visible from front view of person.
- Your own voice should sound muffled or hollow (like an echo or being in a tunnel).
- If proper fit was not obtained, remove plugs and re-insert with proper technique.



***Proper  
Fit***



***Incorrect  
Fit***

# Hearing Protection Devices

## Molded/Pre-molded



- Soft, flexible devices (silicone/plastic/rubber) that fit into ear canal
- Variety of styles, some sized
- FLANGES provide seal against canal wall
- Re-useable ...retain size and flexibility, if kept clean daily with soap and water

# Hearing Protection Devices

## *Advantages & Disadvantages*

### Molded (flanged) plugs

#### **Advantages:**

- Stem for clean insertion
- Variety of sizes
- Carrying case-convenient
- Washable, re-useable

#### **Disadvantages:**

- May need different size for each ear and individual fit.

#### **Critical Tip:**

- Insert and remove with rotation/twisting motion
- Do not pull straight out upon removal



# Hearing Protection Devices

## Earmuffs



- Ear cushions that seal against head and directly over outer ear
- Made of smooth, plastic envelope filled with foam or fluid material
- Require periodic replacement (cushions become stiff or brittle)- **Inspect daily** for defects
- Easily seen for use/compliance at distances
- One size fits most
- Generally provide greater protection
- Can be uncomfortable in hot work areas, or vigorous work activity

# Hearing Protection Devices

## Earmuffs

*After inspection, reasons for replacement*



# Hearing Protection Devices

## *Advantages & Disadvantages*

### Earmuffs

#### Advantages:

- Easy to fit properly
- Designed to fit “most” people
- Less time & effort applying and fitting
- Easily visible/monitored
- Not misplaced/lost as easily

#### Disadvantages:

- Uncomfortable in hot environments
- May be cumbersome & restrict head motion
- Hair, beards, sideburns and glasses can alter protection
- Protection less in low frequency noise environment

# Interventions and outreach with the Hearing Loss Prevention Unit

- Traveled to 42 sites nationwide
- Performed 5,414 series of tests on...
  - 3,609 workers
  - 1,914 miners



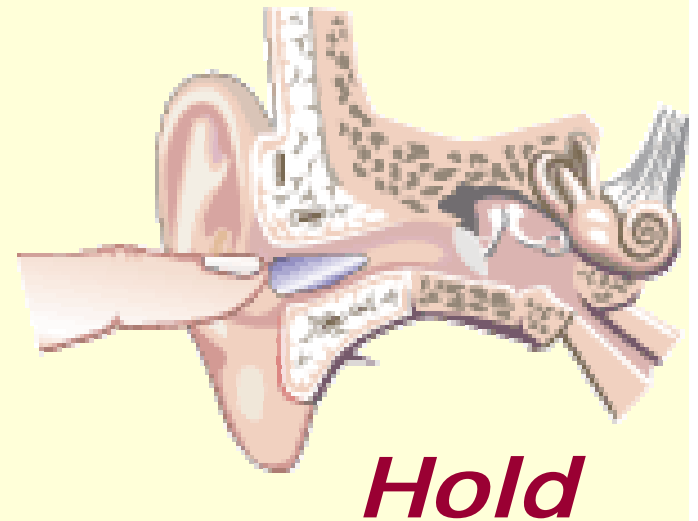
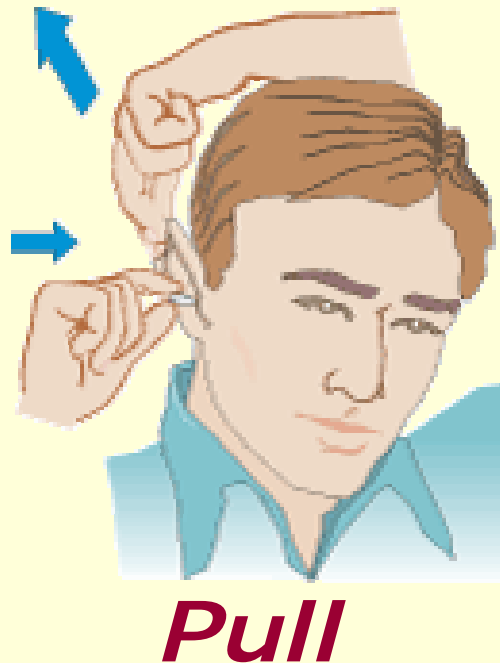
Updated: 6/16/2005



# Roll-Pull-Hold earplug technique

You've heard of: *Stop, Drop, Roll*

Now there's ***Roll, Pull, Hold***





# Simplify the instructions:



1. With clean hands, **ROLL** entire ear plug into narrowest possible crease-free cylinder.  
 • Con las manos limpias, **ENROLLE** todo el tapón a un cilindro lo mas angosto posible, sin arrugas.  
 • Avec les mains propres, **ROULEZ** le bouchon en entier afin d'obtenir un cylindre le plus mince possible et sans plis.
  2. Reach over head with free hand, pull ear up and back and **INSERT** ear plug well inside ear canal.  
 • Mientras alcanza sobre su cabeza, jale su oreja hacia arriba y hacia atras e **INTRODUZCA** el tapón adentro del oído.  
 • Passez la main libre au-dessus de la tête et tirer la pointe de l'oreille vers le haut et vers l'arrière. **INSEREZ** le bouchon antibruit dans le conduit auditif.
  3. **HOLD** for 40 seconds, until plug fully expands in ear canal.  
 • **SOSTENGA** por 40 segundos, hasta que el tapón se expanda totalmente en el canal auditivo.  
 • **MAINTENEZ** pendant 40 secondes, jusqu'à ce que le bouchon reprenne sa forme initiale dans le conduit auditif.
- PROPER FIT** While in a noisy environment and with ear plugs inserted, cup both hands over ears and release. The ear plugs should be blocking enough noise so that covering them with your hands should not result in a significant difference. If proper fit is not obtained, move to a quiet location and repeat Fitting Instructions.
- COLOCACION APROPIADA** En un ambiente ruidoso y con los tapones de oídos insertados, ponga sus manos en copa sobre los oídos y luego suéltelos. Los tapones auditivos deben bloquear suficientemente el ruido de modo que no haya diferencia notable. Si no se consiguen una colocación apropiada, ir a un lugar callado y repita las instrucciones.
- INSERTION CORRECTE** Dans un environnement bruyant, apri antibruit, placez la paume de vos mains sur vos oreilles puis r antibruit devraient éliminer suffisamment de bruit pour ne pas significative. Si les bouchons antibruit ne sont pas bien insérés zone non bruyante et répéter le mode d'insertion.

- WARNING!** Remove ear plug slowly with twisting motion t  
 Rapid removal may damage ear drum.
- ¡AVISO!** Quite lentamente el tapón auditivo mientras gira e  
 romper gradualmente el sello. Si se quita rápidamente pue
- AVERTISSEMENT!** Enlever le bouchon lentement en le tou  
 au fur et à mesure. L'enlèvement rapide peut endommager



Roll  
 Rollen  
 Rouler  
 Girar  
 Enrole



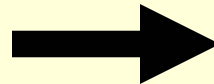
Insert  
 Einführen  
 Introduire  
 Introducir  
 Introduza



Hold  
 Festhalten  
 Maintenir  
 Sustener  
 Segure



Howard Leight Industries San Diego, CA 92154 USA  
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 Patents: US: 329897, 335342; Canada: P71,178  
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## Putting in soft foam earplugs

To get the best protection from your soft foam earplugs, remember to **roll**, **pull**, and **hold** when putting them in. Use clean hands to keep from getting dirt and germs into your ears!



**1. Roll** the earplugs up into a small, thin "snake" with your fingers. You can use one or both hands.



**2. Pull** the top of your ear **up and back** with your opposite hand to straighten out your ear canal. The rolled-up earplug should slide right in.



**3. Hold** the earplug in with your finger—as far as it will go. Count to 20 or 30 **out loud** while waiting for the plug to expand and fill the ear canal. Your voice will sound muffled when the plug has made a good seal.

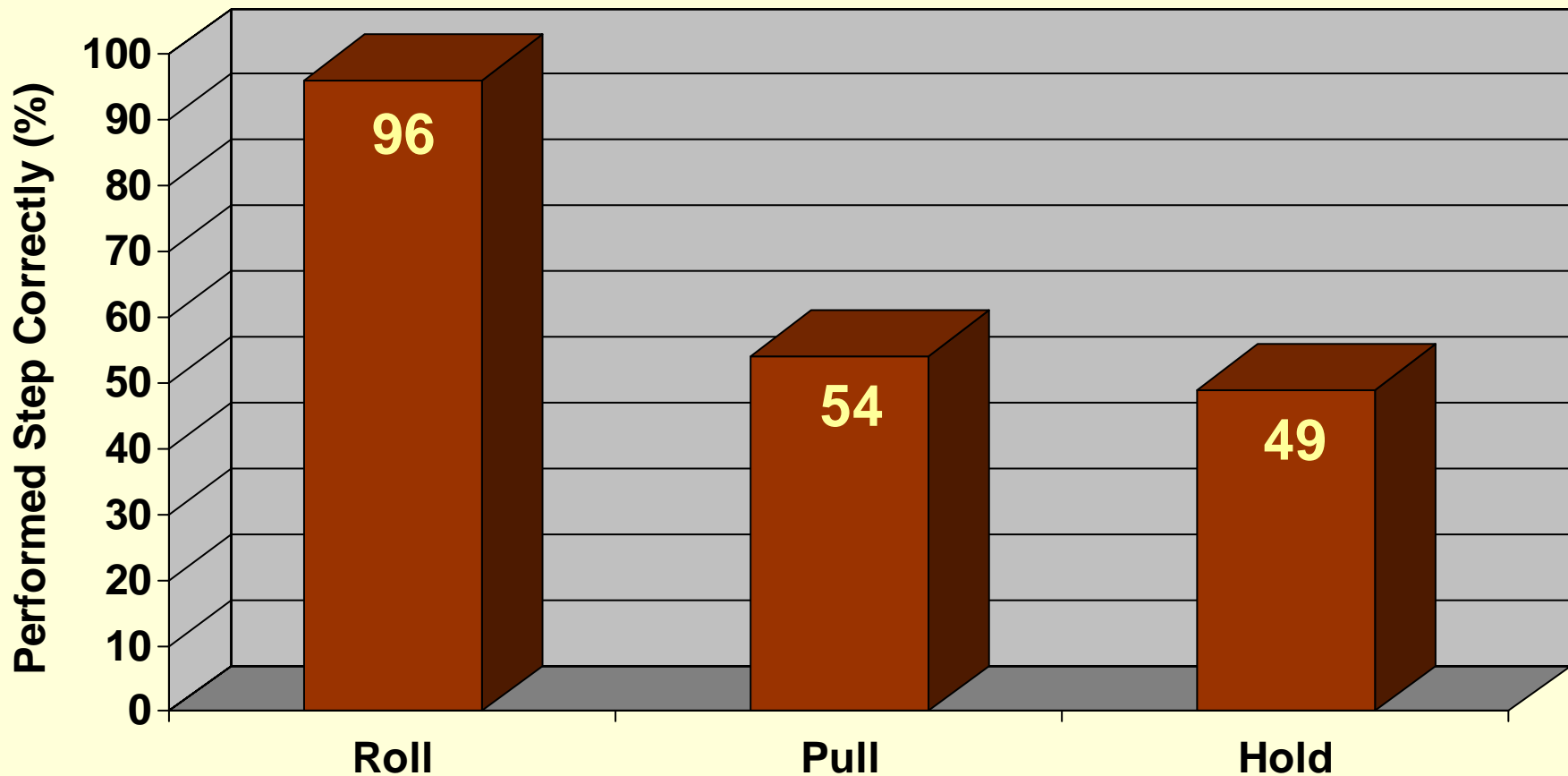
**Check the fit** when you're all done. The entire foam body of the earplug should be within the ear canal. Try cupping your hands tightly over your ears. If sounds are much more muffled with your hands in place, the earplug may not be sealing properly. Take them out and try again.



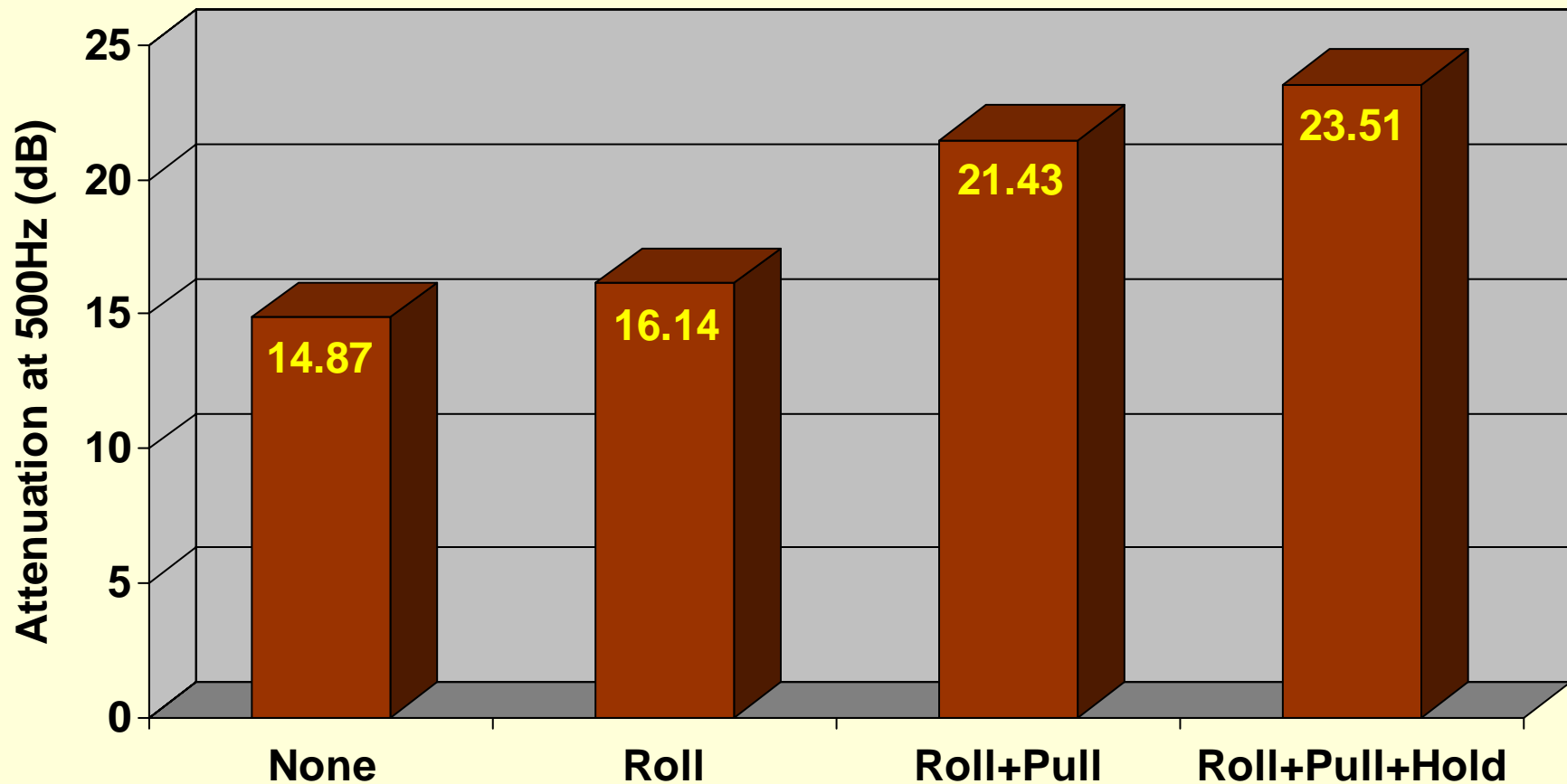
U.S. Department of Health and Human Services  
 Centers for Disease Control and Prevention  
 National Institute for Occupational Safety and Health  
 www.cdc.gov/niosh - 1-800-35-NIOSH



# Correct Completion of Roll-Pull-Hold steps



# Increased earplug attenuation from completing Roll-Pull-Hold steps





# Hearing Protection Devices

## *Noise Reduction Ratings*

- NRR required on all HPD labels
- A measure of hearing protector *attenuation* (noise reduction)
- Determined in a lab with ***open*** and ***occluded*** (protected) ears on trained subjects
- Based on decibel *difference* between the open and occluded hearing thresholds

# Noise Reduction Ratings (NRR)



# Hearing Protection Devices

## *Noise Reduction Ratings*

- Some people select HPD's by the highest NRR
- ***But*** NRR tends to overestimate real-world protection
- The NIOSH Noise Criteria document (1998) suggests derating:
  - Earmuffs - **25%**
  - Foam plugs - **50%**
  - Molded (flanged) plugs - **70%**
- Derating is still only a rough guide – actual protection can vary

# Derating Examples

**Muffs:**

**NRR=20**

**Derated by 25% to 15**



**Foam plugs:**

**NRR=29**

**Derated by 50% to 14.5**



**Molded plugs:**

**NRR=27**

**Derated by 70% to 8**

# Dual Protection



+



*Using a combination of ear plugs and muffs.*

Recommended for exposures of 8 hours above 100-105dB(A) (time weighted avg.)

- Examples: Roof bolter, underground auxiliary fans, continuous miner, miner/bolter, coal processing equipment
- To compute NRR from dual protection:

Add **5dB** to the HPD with most protection/highest derated NRR of two selected

# For more information

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# Questions ???



*Value the “gift” of hearing--Sounds good to me !!*

